Maryland Comprehensive Energy Outlook

Chapter 1 *DRAFT*

Demand and Supply Information

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1.0 EXECUTIVE SUMMARY

This Comprehensive Energy Outlook is intended as a proactive "state of the State" review of Maryland energy issues. Last conducted in 1993, the goal of this effort is to promote affordable, reliable and clean energy by identifying emerging energy challenges, evaluating potential policy options and recommending practical solutions. To minimize the risk of future rate shocks or other energy challenges, MEA has launched this broad effort to assess all of our basic fuel sources, including direct fuels such as home heating oil and propane, the transportation sector, and the electric and gas industry.

This first chapter provides energy demand and supply data and information, for the years 2009 to 2018, for different fuels and energy sectors in Maryland.

Data is drawn from five primary sources:

- Public Service Commission (PSC) of Maryland, *Ten-Year Plan (2008-2017) of Electric Companies in Maryland*
- U.S. Department of Energy, Energy Information Administration (EIA)
- American Council for an Energy-Efficient Economy , *Energy Efficiency: The First Fuel for a Clean Energy Future*

  Maryland Department of Natural Resources, Power Plant Research Program, *Maryland Power Plants and the Environment: A review of the impacts of power plants and transmission lines on Maryland's natural resources (CEIR-14)*
- Maryland Commission on Climate Change, *Maryland Climate Action Plan*

Much of the data, drawn from EIA, reflects 2006 energy demand and may not be indicative of current 2009 energy demand patterns. However, for purposes of this report and to identify any major energy issues, this data is considered to be representative of Maryland's energy demand and supply picture. In addition, electric data drawn from PSC sources reflects end of year 2008 information and does not reflect current economic conditions or recent information updates that are not publicly available.

Current and potential future energy use requires identification and analysis of energy use in Maryland. This report discusses demand in three major categories: direct use, transportation, and electricity. The direct use portion of this report includes all energy not used for transportation or in the generation of electricity. For example, much direct use energy is used for residential heating or direct-fueled industrial processes. The fuels included in this category include natural gas, coal, petroleum and biomass. Direct use of energy accounts for 21% of total Maryland energy demand.

Transportation fuels are discussed in the second section of this report. Transportation fuel use represents 32% of all energy used in Maryland and includes petroleum fuels such as gasoline and diesel along with some natural gas, propane, biodiesel and ethanol.

The last major segment of this report covers electricity generation and use. Generation of electricity consumes 47% or nearly half of all the energy consumed in the State. The majority of this energy or over 88% is derived from coal and nuclear fuel resources. As noted by the Maryland Public Service Commission (PSC), expected growth in peak demand and electricity usage from 2009 to 2018 is due to expected population growth and economic activity, although the current economic recession has lessened the expected gap between future demand and supply in Maryland. Other key variables that drive the expected growth in peak demand and electricity usage include state and utility energy efficiency programs, general employment levels, energy prices, population, weather, new technologies and general usage patterns.

In terms of overall energy use, Maryland continues to face a demand and supply imbalance. While it may not be cost-effective for the state to be totally self supporting, there are approaches to lessening demand and increasing supply that can help reduce Maryland’s energy imbalance. Adequate supplies of energy for direct use, transportation and reliable electric generation will require continuation of current approaches and energy policies and implementation of new approaches that can more effectively meet the needs of all Maryland energy consumers.

In developing this Comprehensive Energy Outlook, existing data sources were used to present an estimated demand and supply picture of energy in Maryland. Use of publicly available data supports a cost-effective approach to reviewing energy concerns and can provide a basis upon which to identify key energy issues facing Maryland and to help determine real-world solutions.

2.0 Overview of Energy Supply, Demand, and Prices in Maryland

According to latest data from U.S. DOE's Energy Information Administration (EIA), Maryland's total energy demand in 2006 was 1,452 Trillion Btu, or approximately 1.5% of all energy demand in the United States. To meet that demand, energy supplies continue to be met by a substantial volume of imports in many of Maryland's energy sectors. With limited internal energy resources, direct use fuels such as coal, natural gas, and petroleum must be imported not only internationally, but also from southern and western states that have available supplies. With almost 91% of the transportation sector dependent on petroleum resources, Maryland must import well over 400 trillion BTUs of petroleum products to meet consumer demand. In the electrical sector, Maryland not only imports most of the fuels needed to generate electricity, but imports approximately 30% of its electrical energy needs over a congested transmission system from surrounding state electricity supplies.

Maryland has no known petroleum production areas and is dependent on product deliveries from other areas of the country as well as from abroad. The state is supplied primarily by the Colonial Pipeline on its way from the Gulf region to major Northeast population centers. In 2005, ethanol became an additive for motor gasoline in Maryland to support clean air policies. Ethanol requires truck, rail or barge transport, which complicates logistics and exposes Maryland to potential supply disruptions. To fulfill Maryland's ethanol blending requirements, an annual ethanol supply of approximately 300 million gallons is needed.

Demand for natural gas is strong with EIA reporting that nearly one-half of Maryland households use natural gas for home heating. For natural gas supplies, the state utilizes interstate natural gas deliveries and imports from abroad. Major pipelines originating from the Gulf Coast help supply natural gas to Maryland consumers. These include pipelines from five major entities: Columbia Gas Transmission Corp., Dominion Transmission Co., Eastern Shore Natural Gas Co., Texas Eastern Transmission Corp., and Transcontinental Gas Pipeline Co. One of five existing U.S. liquefied natural gas (LNG) import facilities is located at Cove Point on the Chesapeake Bay's western shore. The Marcellus Shale formations, as part of the Appalachian mountain area in western Maryland, may provide additional gas supplies into the future depending on commodity price and resources need to extract the supply from shale formations.

While Maryland has some coal resources in the western part of the state, actual mining operations are limited and little of this resource is being used to provide Maryland energy. Most of the coal used in Maryland comes from western states. Heavily dependent on rail transportation, coal comes from as far away as the Powder River Basin in Wyoming as well as from other mines as close as West Virginia.

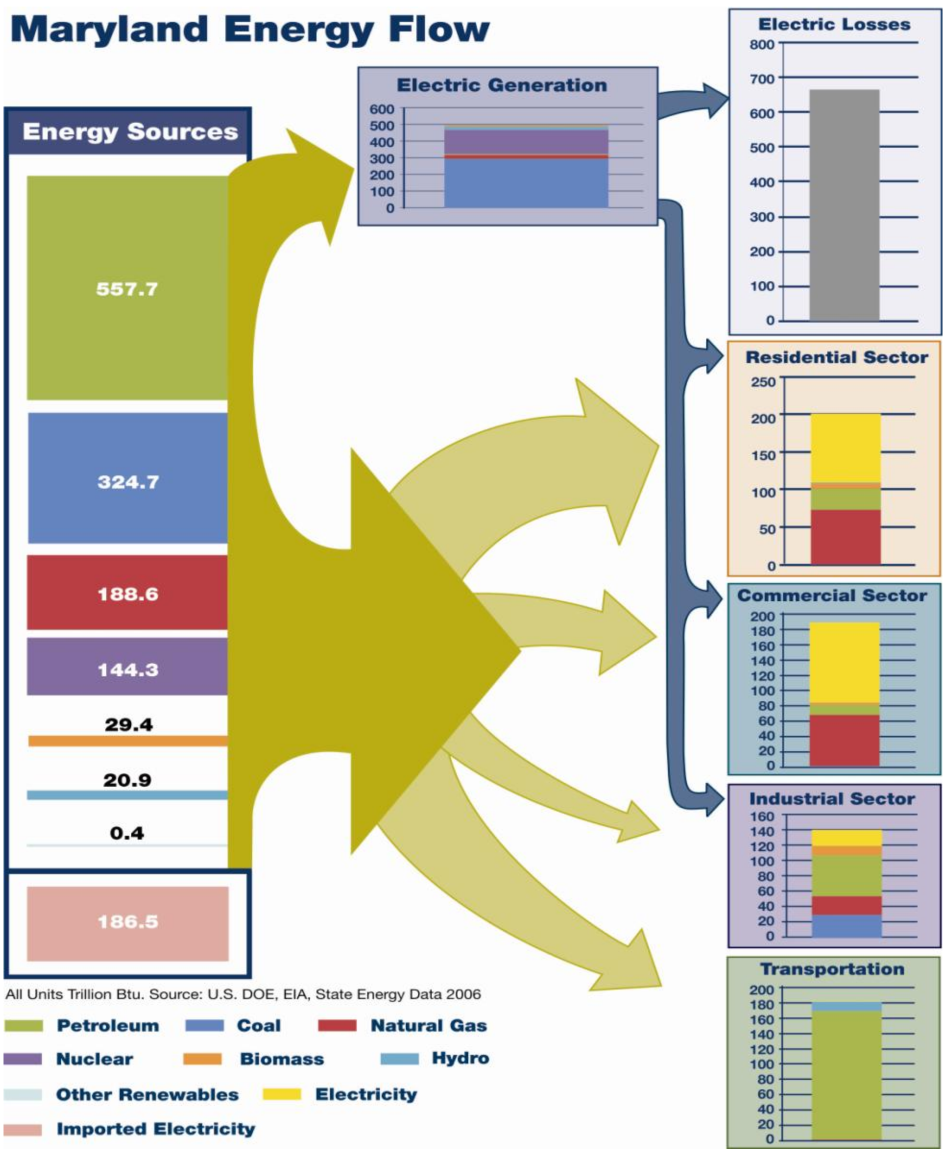
Electricity sector demand increased 16% from 1997 to 2007 in the State, while generation increased by approximately 7%. For the year of 2007, EIA reports that electricity sales in Maryland totaled 65,391,000 Megawatt-Hours (MWh), while net generation was 50,198,000 MWh. 15,193,000 MWh or approximately 23% of electricity was imported from out of state. This is the equivalent of over 2,000 Megawatts (MW) or four (4) generation power plants. The state also lacks fuel diversity in its electricity generation. Of the electricity generated in 2007, 88% was derived from two sources: coal-fired and nuclear-powered generation facilities.

Maryland is part of the PJM Interconnection, or power grid, which currently encompasses 13 states and the District of Columbia. PJM has an installed capacity of 163,000 MW, serving more than 50 million people. PJM serves as the area's regional transmission organization (RTO), ensuring the reliability of the electric power supply system for all electricity consumers. PJM operates the wholesale electricity market, and manages a long-term regional electric transmission planning process to maintain the reliability of the power supply system.

Maryland's dependency on electricity imports has led to a strained transmission system. The Delmarva Peninsula and the Baltimore/Washington metropolitan areas have been identified by the U.S. Department of Energy (DOE) as among those areas where higher prices and lower reliability can be traced to transmission congestion. DOE explains that this congestion is leading to "transmission bottlenecks" that hold up the economic flow of electricity from the generation source to points of use and threatens reliability. DOE is not alone in this determination; PJM has stated that without transmission upgrades, Maryland will not meet federally mandated reliability criteria within the next 15 years.

Exhibit 1 presents a visual picture of Maryland's total energy supply, distribution, and use.

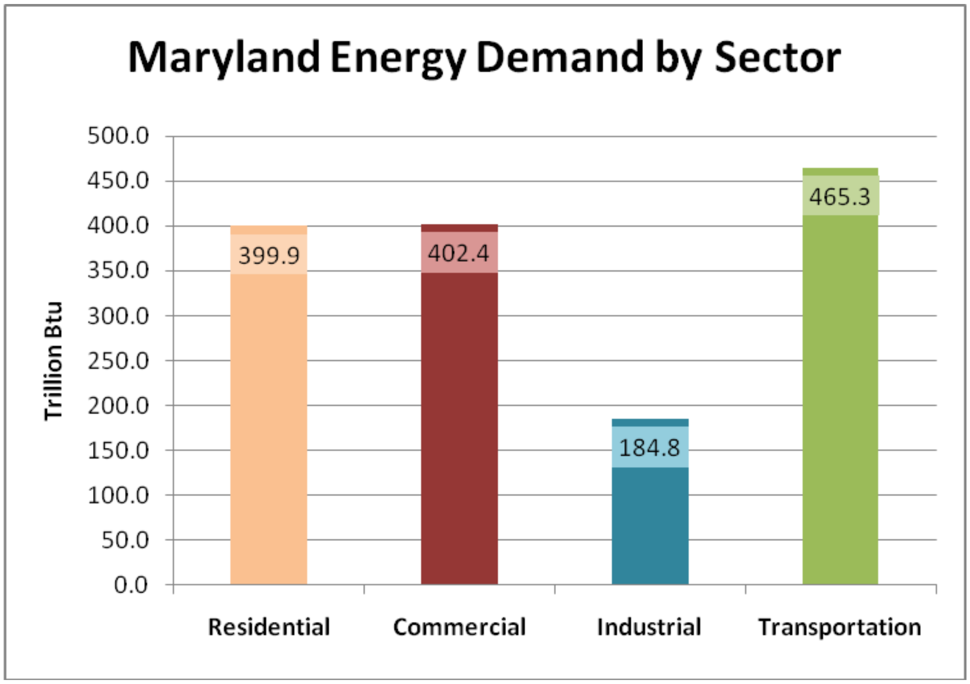
Exhibit 1



2.1 Energy Demand

As illustrated below in Exhibit 2, among the four end-use sectors, the transportation sector consumes the most energy at 32% of all energy in Maryland. Residential and commercial sectors each account for 28% of total energy demand. The most notable difference between national energy demand patterns and Maryland's demand is in the industrial sector. While in Maryland the industrial sector consumes only 13% of total energy, nationally, the industrial sector accounts for the largest share of total energy demand, 32%.

Exhibit 2



Source: U.S. DOE, EIA, State Energy Data 2006 (latest available data)

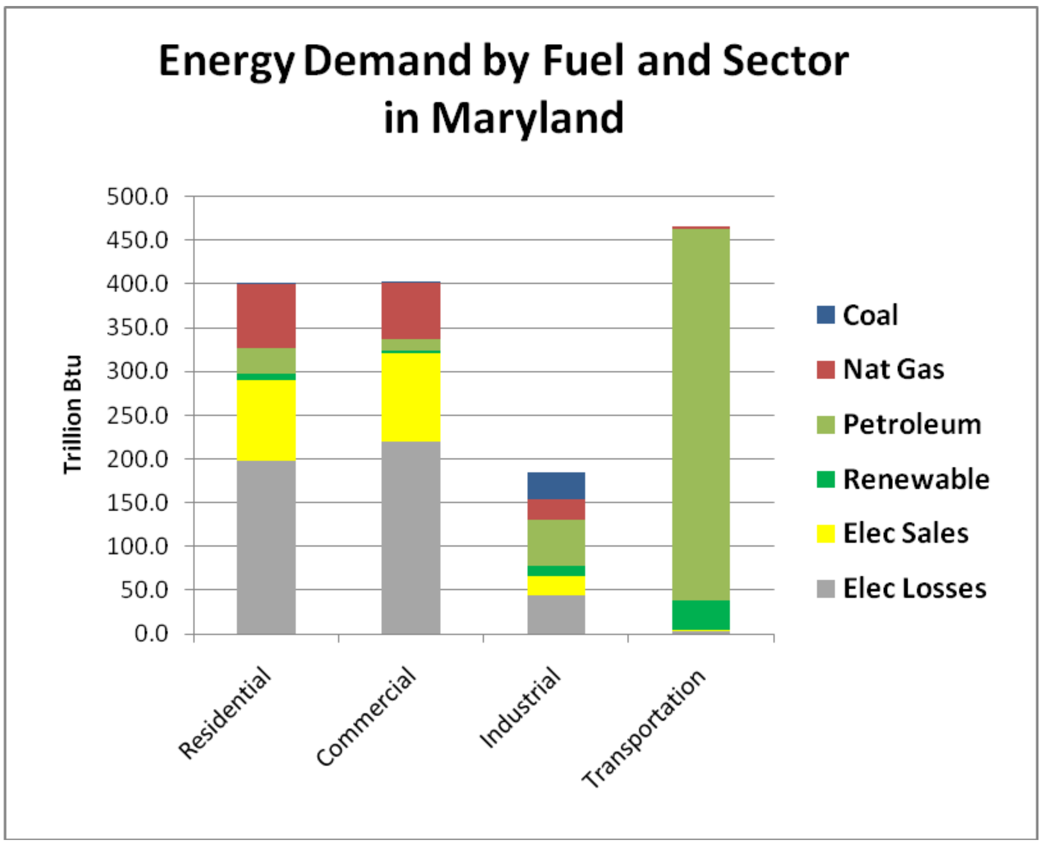
As illustrated in Exhibit 3, in the residential sector, electricity accounts for 73% of all energy demand. Natural gas, petroleum products, and wood account for 18%, 7% and 2%, respectively. In addition, a small but growing portion of residential sector energy comes from distributed generation (DG) in behind-the-meter installations using solar photovoltaics and small wind turbines.

In the commercial sector, 79% of all energy demand is from electricity. Natural gas is the other major fuel source, comprising 16% of commercial sector energy demand.

Compared to the residential and commercial sectors, the energy mix in the industrial sector is more diverse. 35% of all industrial energy demand is from electricity. Petroleum products are the second largest energy source at 29%, followed by coal (16%), natural gas (13%), and biomass (7%).

Not surprisingly, the vast majority of energy demand in the transportation sector is from petroleum. In 2006, petroleum accounted for 91% and biofuels approximately 7% of all energy demand in the sector.

Exhibit 3

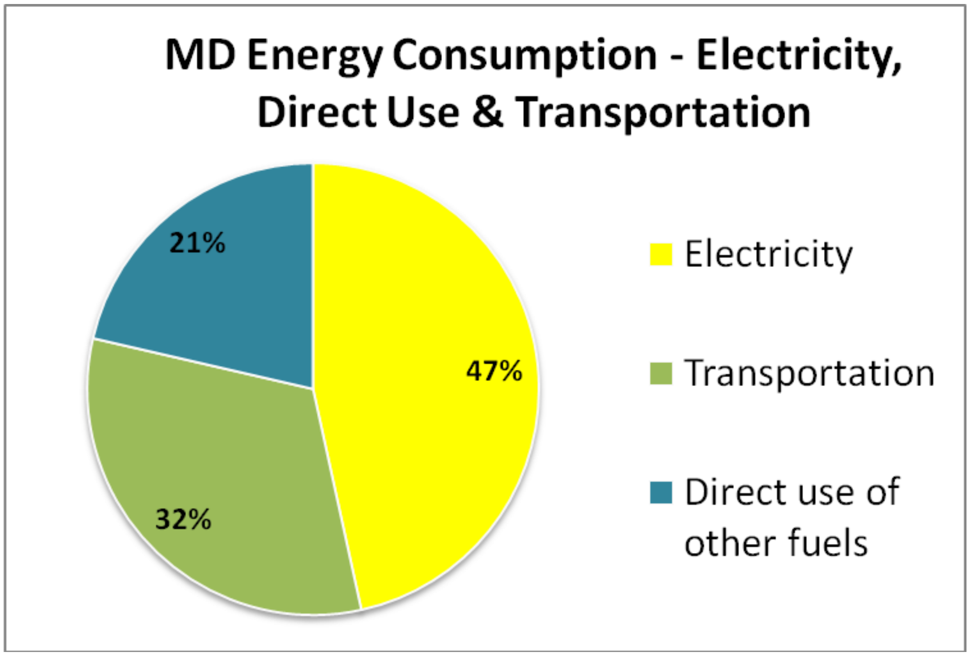


Note: Petroleum includes motor gasoline, diesel, heating oil, propane, and other petroleum products. Renewable energy includes wood and other biomass, geothermal, solar and wind energy.
Source: EIA State Energy Data 2006 (latest available data)

2.2 Direct Use Fuels, Transportation and Electricity – Overview

Energy is used in three principle ways by all energy consumers: (1) Maryland citizens and businesses may use direct fuels to heat their homes or drive commerical or industrial proceses. (2) They most likely use energy for transportation, shipping bulk commodities and products, shopping, traveling and daily work activities. (3) And most dramatically, Maryland consumers use electricity in a variety of ways from powering their homes, businesses and industry to keeping the lights on and handling everyday chores. As shown in Exhibit 4, while 47% of our energy is consumed as electricity, transportation and direct use account for the other 53%. In this section we present additional data on energy demand and supply as used in these three principle ways.

Exhibit 4



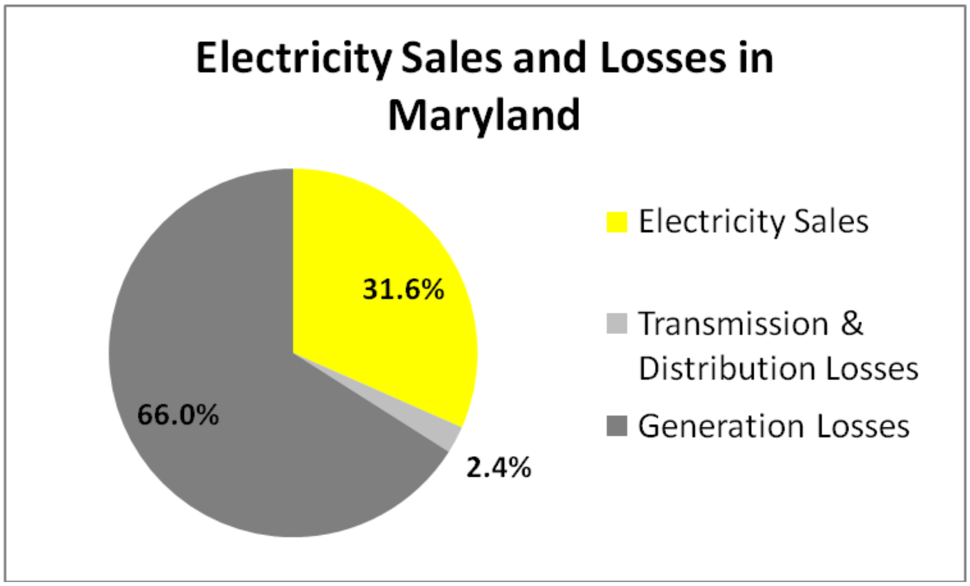
Source: EIA State Energy Data 2006 (latest available data)

2.3 Energy Losses

A large portion of the energy used in the residential, commercial and industrial sectors is lost. The U.S. Department of Energy estimates that, on average, approximately 7% of generated electricity is lost in the transmission and distribution system. The rest of the electricity losses occur at generating plants, mostly in the form of heat loss.

As seen in Exhibit 5, of all energy consumed by electric generators, only 31.6% is delivered to end users as electricity sales; 2.4% can be attributed to losses in the transmission and distribution system. The rest, or 66%, consists of energy losses at electric generating plants and other electric system losses.

Exhibit 5



Source: EIA State Energy Data 2006 (latest available data); U.S. DOE Transmission & Distribution Loss Estimate

While the above chart reflects the energy losses within the electrical sector, there are equivalent energy losses in the transportation and direct fuel use processes. For basic car and truck transportation systems approximately 15% of the energy content actually gets converted to useful energy to move vehicles and passengers or provide heating or cooling. The remainder is lost in system inefficiencies.

In direct fuel uses, both home and process heating/cooling requirements must recognize the typical 65% efficiencies associated with the end use equipment. With this level of losses in our energy system, it would appear important to continually review opportunities for efficiency improvement and to pursue new technologies and processes that can not only help reduce energy demand but also contribute to increasing the efficiencies of direct fuel use, electrical generation, transmission, distribution and transportation options. A question to be answered is where and how we can best improve energy efficiencies to reduce demand and use our energy more effectively.

2.4 Per Capita Use of Energy

As indicated in Table 1 below, based on the latest available data from EIA, total per capita use of energy in Maryland is relatively low. Our 259.3 million Btu per capita energy use ranks us ninth lowest among all states and lower than any other Mid-Atlantic states.

However, state per capita energy use levels are greatly affected by economic, geographic and climatologic differences between states. For example, Alaska, with the highest per capita use of energy, has a harsh climate compared to other states, is a large and sparsely populated state, and has an economy dominated by energy-intensive industries. Indiana, whose economy is more industrial than many other states, has the ninth highest energy use among all states. Maryland's relatively small industrial base compared to many other states is likely a key factor in bringing down our per capita energy use.

Table 1

Mid-Atlantic States & District of Columbia	Per Capita Energy Use (million Btu per person)	Rank
Maryland	***259.3***	***9th***
District of Columbia	299.9	15th
New Jersey	300.6	16th
Pennsylvania	317.1	21st
Virginia	333.1	25th
Delaware	352.5	32nd
Other Selected States		
New York	204.3	2nd
California	232.3	4th
Indiana	454.1	43rd
Alaska	1,112.2	51st

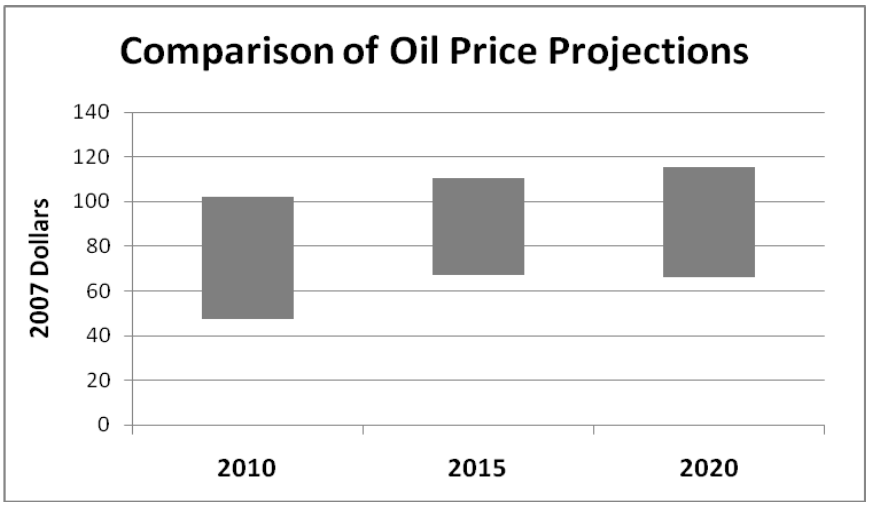
Source: EIA State Energy Data 2006 (latest available data)

2.5 Energy Price Outlook

2.5.1 Oil Prices

As the last few years have proven, projecting future oil prices is a very inexact science and prone to many unexpected variations. In its *Annual Energy Outlook 2009*, the EIA projects that oil prices will reach $80 per barrel in 2010, $110 in 2015, and $115 in 2020 (in 2007 dollars). Many other credible organizations and agencies have published oil price projections, and Exhibit 6 identifies the price ranges for 2010, 2015 and 2020 in seven different price forecasts. For 2015 and 2020 prices, EIA projects higher prices than most of the other projections.

Exhibit 6



Source: EIA Annual Energy Outlook 2009, Comparison with Other Projections

2.5.2 Natural Gas Prices

The *Annual Energy Outlook 2009* projects that natural gas prices will increase between 2008 and 2018, as more expensive domestic sources are used to meet demand. *AEO 2009* projects Henry Hub natural gas prices to increase 6% from 2007 to 2018, from an average of $6.96 per million British thermal unit (MMBtu) of energy in 2007 to $7.38 per MMBtu in 2018. As with price projections for other fuels, economic growth rates will affect future demand and prices of natural gas. In addition, the pace of technological progress in natural gas production will affect prices.

2.5.3 Coal Prices

The *Annual Energy Outlook 2009* expects the growth in coal demand to slow compared to past decades. *AEO 2009* forecasts that U.S. average coal prices will increase in the short term, from $1.27 per MMBtu in 2007 to $1.47 per MMBtu in 2009. After this initial increase, coal prices are expected to gradually go down, reaching $1.41 per MMBtu in 2018.

2.5.4 Electricity Prices

According to the EIA, average Maryland electricity rates in 2007 were $0.1189 per kilowatt-hour (kWh) for residential customers, $0.1158 per kWh for the commercial sector, and $0.0941 per kWh for the industrial sector.

In its 2008 *Energy Efficiency: The First Fuel for a Clean Energy Future* the ACEEE projected Maryland residential electric rates to average $0.115 per kWh from 2010 to 2014 and $0.128 per kWh from 2015 to 2019. ACEEE projected commercial sector rates to average $0.116 per kWh between 2010-2014 and $0.131 per kWh between 2015-2019, and industrial rates $0.073 per kWh between 2010-2014 and $0.080 per kWh between 2015-2019. These price projections assumed that ACEEE policy recommendations for energy efficiency and load reduction are implemented.

As seen in Table 2, price comparison of residential electricity rates among nearby states for November 2006 and 2007 shows Maryland having higher prices than the national and South Atlantic Regional averages. In addition, price escalation in Maryland between November 2006 and 2007 was more rapid than in other nearby states.

Table 2

Residential Electricity Prices (cents/kWh)		
State/Area	**April 2008**	**April 2009**
Delaware	13.87	14.20
New Jersey	14.05	15.89
Maryland	***13.34***	***14.82***
Pennsylvania	11.17	11.61
Washington D.C.	11.11	12.73
Virginia	8.97	10.73
West Virginia	7.06	7.97
South Atlantic Region average	*10.40*	*10.73*
National average	*11.02*	*11.59*

Source: EIA, April 2009

Future electricity prices in Maryland will depend on the price of fuel required by generation facilities. In addition, transmission system constraints in the Mid-Atlantic region are causing electric providers to pay congestion charges for the electricity they deliver. Thus, relieving regional transmission constraints may lower electricity prices in Maryland, assuming that the levelized cost of transmission upgrades is not higher than the congestion charges.

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Future electricity prices in Maryland will depend on the price of fuel required by generation facilities and how the regional electricity markets operate. While base load coal and nuclear generation prices have served to set electricity prices for over 70 to 80% of the time, gas fired generation has set somewhat higher prices during peak demand periods. Our electric pricing structure is dependent on the operation of deregulated markets and energy price bids as proposed by generation companies or 3rd party suppliers. In addition, transmission system constraints in the Mid-Atlantic region are causing electric providers to pay congestion charges for the electricity they deliver. Thus, relieving regional transmission constraints may lower electricity prices in Maryland, assuming that the levelized cost of transmission upgrades is not higher than the congestion charges.

2.5.5 Energy Prices in General

Residential customers, businesses and industry are all impacted by energy prices which are in-turn driven by many different factors. Supply variations, electricity markets, economic downturns, transport issues, financial market speculations and a myriad of other factors can enter into the pricing variations around energy. While attempting to secure the lowest price energy can be in the best short term interest of consumers, it fails to ensure the long term benefits of supply security, growth of domestic energy sources, a cleaner environment, technology and economic development and an effective energy sustainability policy. The question that must be answered is how to pursue the most cost effective energy pricing structures that not only provides affordable prices for Maryland energy consumers but also ensures a sustainable energy future that takes advantage of clean renewables, new technologies and efficiency improvements.

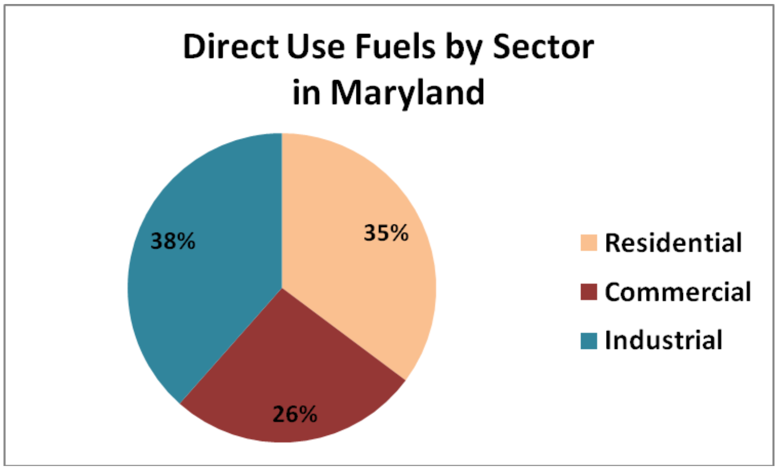
3.0 DIRECT USE FUELS

Direct use fuels accounts for 21% of total Maryland energy demand. The fuels included are natural gas, coal, petroleum and biomass.

3.1 Current Situation

When analyzed by end use sector, as seen in Exhibit 7, the industrial sector accounts for the greatest share of direct use fuels, followed by residential and commercial sectors.

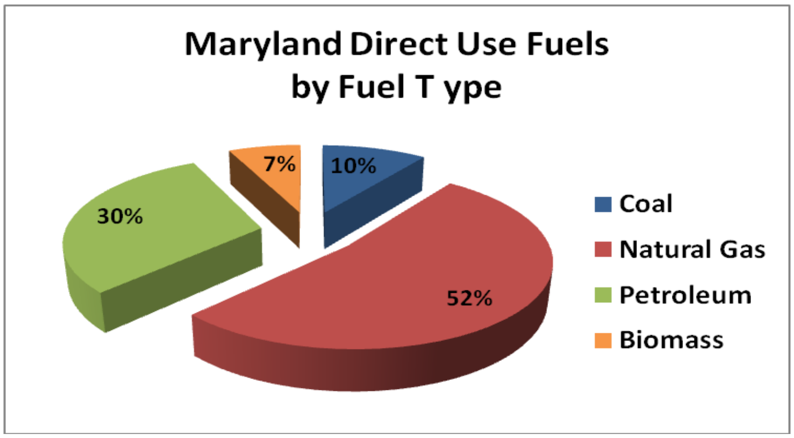
Exhibit 7



Source: EIA State Energy Data 2006 (latest available data)

When broken down by fuel type, as illustrated in Exhibit 8, natural gas accounts for 52% of direct use fuels. Petroleum products, which include heating oil, propane and other petroleum-based products, account for 30% of direct use fuels. Coal demand is 10% and biomass 7%.

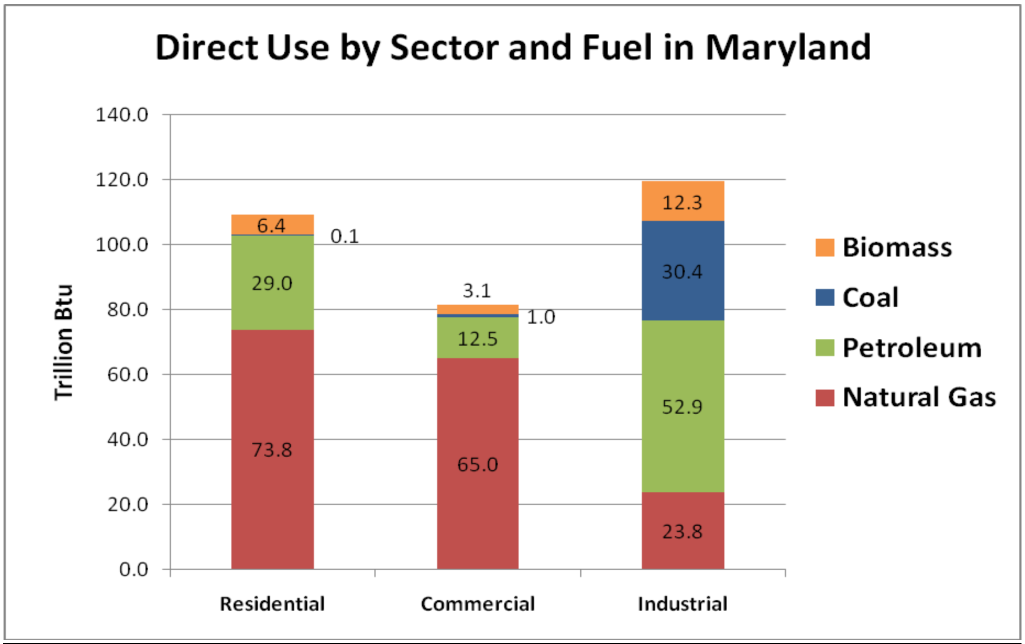
Exhibit 8



Source: EIA State Energy Data 2006 (latest available data)

Exhibit 9 further breaks down direct use of fuels in the residential, commercial and industrial sectors. In both residential and commercial sectors, direct use of fuels is dominated by natural gas The direct use fuel mix in the industrial sector differs markedly from the residential and commercial sectors. In the industrial sector, petroleum-based products dominate.

Exhibit 9



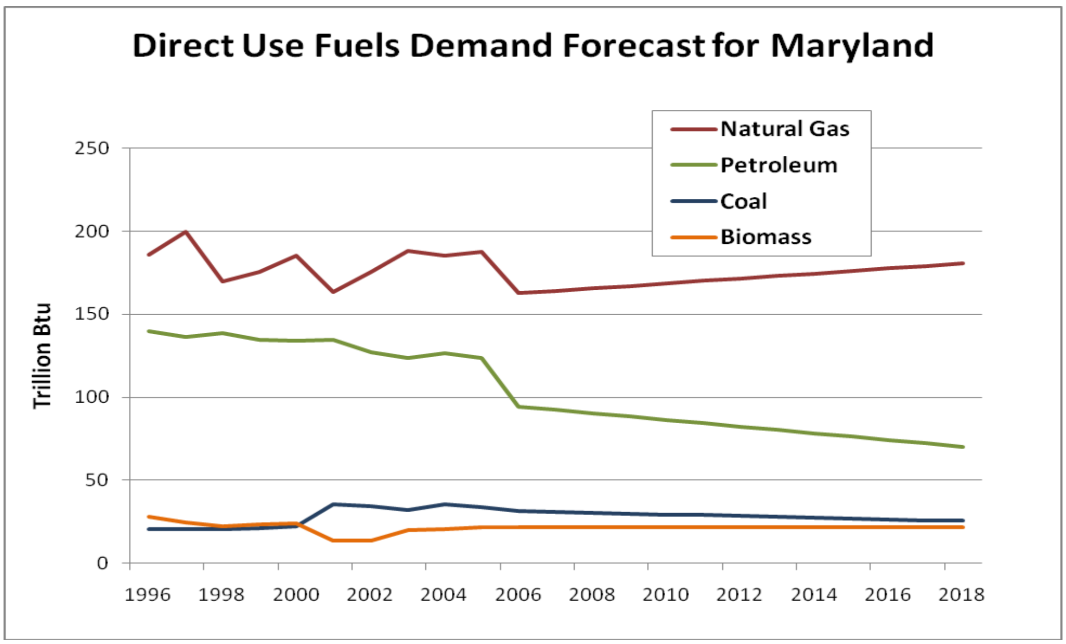
Note: Biomass includes wood and other biomass waste. Petroleum includes motor gasoline, diesel, heating oil, propane, and other petroleum products.
Source: EIA State Energy Data 2006 (latest available data)

3.2 Future Outlook for Direct Use Fuels

There are no Maryland-specific demand projections for direct use of natural gas, petroleum, coal or biomass. In the absence of such data, future demand projections for direct use of these fuels was developed by extrapolating from EIA historical demand data from 1995 to 2006. As seen in the exhibit below, direct use of natural gas is expected to increase between 2006 and 2018 by 11%. In contrast, direct use of petroleum is expected to decrease by 17% between 2006 and 2018. Based on past demand patterns, direct use of coal and biomass is expected to remain relatively constant.

These demand projections can be affected by future price developments for the fuels in question. For example, high oil prices combined with relatively low natural gas could further increase natural gas demand and depress petroleum demand. If fossil fuel prices escalate rapidly, demand for biomass can be expected to go up. Biomass demand levels are likely to be sensitive to possible future carbon costs and other policy incentives that may be enacted by federal or state governments.

Exhibit 10



Source: EIA State Energy Data 2006 (latest available data); future projection extrapolated from historical data

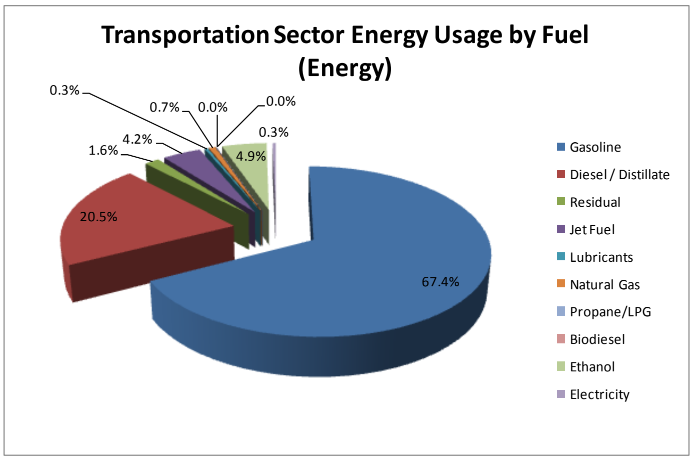
While the above chart reflects a best estimate of future direct fuel demand, there are additional considerations, which might impact Maryland direct use fuel demand. As an example, the potential for fuel switching from the electric sector to direct use natural gas may increase the demand for natural gas while reducing electric generation needs. In certain instances, switching from electricity to direct fuel sources may also improve the efficiency of the energy use process and lessen demand on other fuels. Another example may be consideration for Peak Oil theory. Many industry professionals are suggesting that world production of petroleum products either has or will shortly peak and petroleum supplies will continue to decline over the next several decades. These and many other factors may have significant influence on the demand for direct fuels.

4.0 TRANSPORTATION

4.1 Current Transportation Energy Baseline

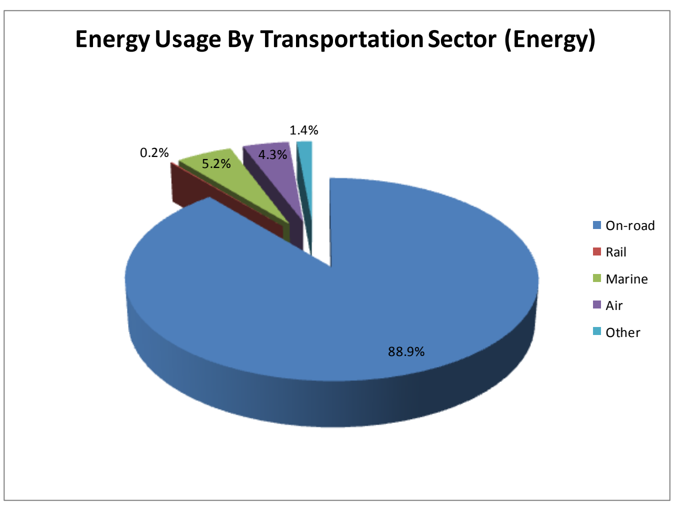
Total baseline Maryland transportation fuel usage is approximately 4.1 billion gallons, or 476 trillion Btu of energy. The baseline fuel usage values in Exhibits 11 and 12 shows that gasoline and diesel account for 86.6% of fuel demand by volume and 88.2% of fuel demand on an energy basis. Ethanol is the next largest fuel, primarily due to its usage in E10 gasoline blends (7.5% by volume, 4.9% by energy). All of the other fuels play a minor role in the State transportation demand market. Natural gas usage includes the fuel used in powering petroleum and natural gas pipelines, which EIA includes in the transportation sector data. This is the major end-use for natural gas fuel. On-road transportation accounts for the largest percentage of fuel use (90.5% by volume, 89.5% by energy). The marine sector is the second largest (roughly 4.5%) followed closely by the aircraft sector (roughly 3.75%).

Exhibit 11



Source: EIA State Energy Profile, FHWA Highway Statistics, Maryland Department of the Environment, Maryland Clean Cities Coalition

Exhibit 12



Source: EIA State Energy Profile, FHWA Highway Statistics, Maryland Department of the Environment, Maryland Clean Cities Coalition

4.2 Future Outlook

A thorough review of existing sources was done to locate historical and projected fuel demand and supply as well as other relevant data such as population and economic growth.[1]

In some cases, future transportation fuels were not included in the MDCAP (e.g., biodiesel and ethanol). In these cases, historical biofuel (biodiesel blends and E85 [a blend of 85% ethanol and 15% gasoline by volume) sales volume data developed for MEA for the Maryland Clean Cities Coalition outside of this project were used as the basis of the projections with conservative assumptions for annual growth in the future. According to MDE most of the gasoline in Maryland contains 10% ethanol (i.e., E10), so 10% of the gasoline fuel volume was assumed to be ethanol. In other cases, fuels were presented in a combined category (e.g. natural gas, liquefied petroleum gas [propane], and lubricants). In these cases the most accurate data from other sources such as the EIA State Energy Data or from the USDOT were used.

4.2.1 Fuel Supply Outlook

As mentioned earlier in this document, no existing transportation fuel supply forecasts have been identified within the literature. As a nearly one-hundred percent energy import state, Maryland must rely on outside supplies to meet transportation fuel demands. Relatively small projected annual Maryland transportation demand side increases are expected to be met by supply side market improvements. For example, the current ethanol fuel supply is sufficient for meeting the projected demand through 2014. After that, the modest projected annual increases do not represent a large enough change in market conditions to warrant a future supply issue. This rationale does not hold true for future biodiesel demand. Biodiesel usage in the low-petroleum/high-biofuels case, which allows the State to meet the EISA RFS requirements, represents a significant shift from current biodiesel usage. By 2018 the biodiesel portion of the Maryland diesel fuel pool will reach roughly 4% of the diesel fuel volume. This is a significant shift that will require significant and immediate additional biodiesel fuel supply, and blending infrastructure to be developed. However, this approach does not require developing additional distribution and fueling infrastructure, as would be necessary in higher level blends, since it would be used in the entire diesel fuel pool.

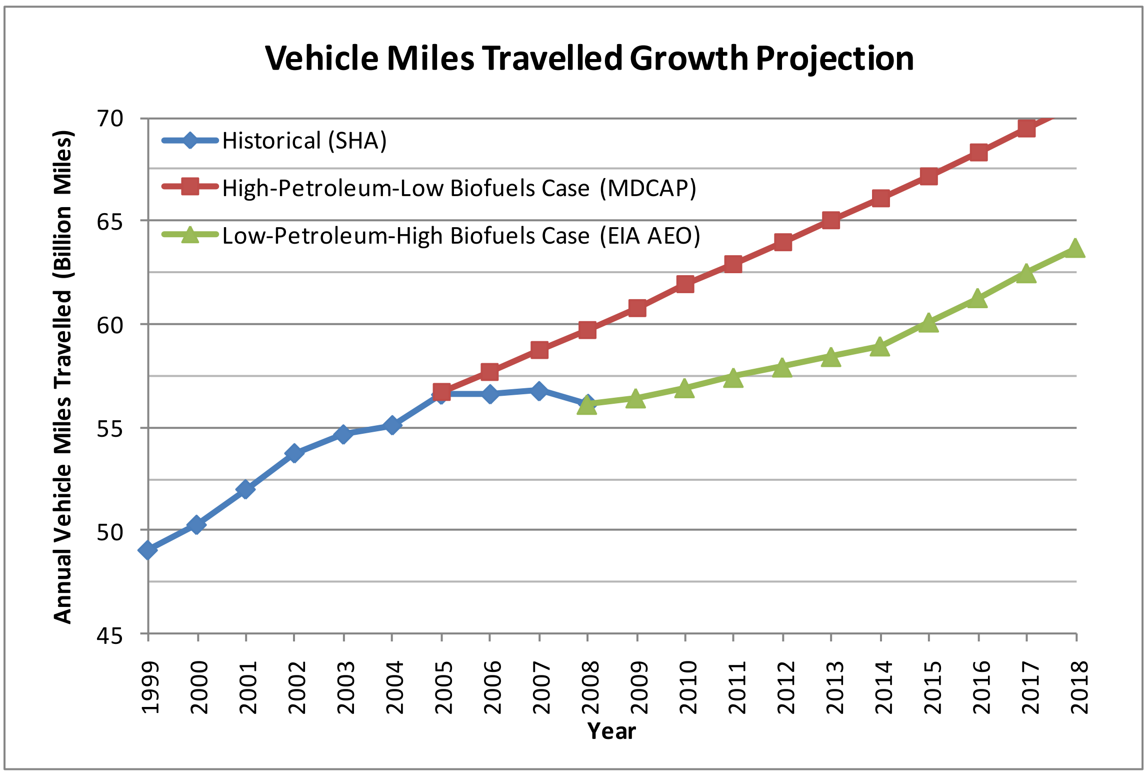
[1] Data sources included: Maryland Energy Administration (MEA), Maryland Department of the Environment (MDE), Maryland Department of Transportation, U.S. Census Bureau, U.S. Department of Defense, U.S. Department of Transportation (USDOT), U.S. Department of Energy (USDOE) - Energy Information Administration (EIA), Regional Greenhouse Gas Initiative, American Council on an Energy Efficient America, and the Chesapeake Bay Foundation. The Maryland Climate Action Plan (MDCAP) transportation data was used as the basis for this task work. The MDCAP study used data from the 2005 EIA State Energy Profile data, so the baseline values were updated using the most current EIA State Energy Profile data. Historical Maryland fleet-wide Vehicle Miles Traveled (VMT) data were obtained directly from MDE and were distributed by vehicle class using USDOT data. Projections were made using Maryland–specific trends and projections based on detailed research and interviews with relevant parties.

4.2.2 Vehicle Miles Traveled (VMT) Projection

Historical vehicle miles traveled (VMT) data was obtained from the Maryland State Highway Administration. VMT projections for the High-Petroleum/Low-Biofuels case were determined by the Maryland Department of the Environment. VMT projections for the Low-Petroleum/High-Biofuels case were determined by applying national VMT growth rates from EIA to the baseline (2009) Maryland VMT value. Exhibit 13 illustrates the VMT projections.

The exhibits diverge in 2005 due to the dates when the data was obtained. The High-Petroleum/Low-Biofuels case was developed using historical data through 2005. The Low-Petroleum/High-Biofuels case was developed using historical data through 2008, which takes into account the combined impacts of higher fuel prices and the current economic downturn that occurred after the High-Petroleum/Low-Biofuels case was developed.

Exhibit 13

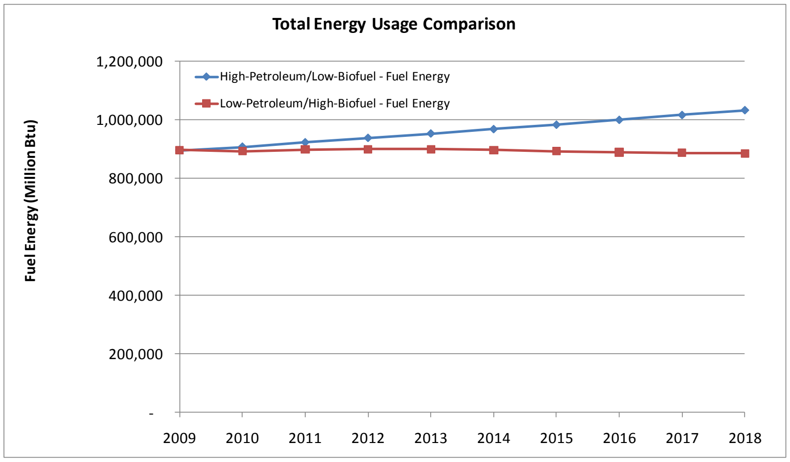


Source: Maryland State Highway Administration, Maryland Departmetn of the Environment, EIA Annual Energy Outlook 2009

4.2.3 Total Fuel Demand

The combined overall fuel demand projections are shown in Exhibit 14. The High-Petroleum/Low-Biofuels case shows a steady increase in gasoline demand; this is "business-as-usual." The difference between this case and the Low-Petroleum/High-Biofuels case is a significant fuel demand decrease (14 percent in 2018) due to higher renewable fuels usage (due to Renewable Fuels Standard [RFS] requirements included in the Energy Independence and Security Act of 2007), higher fuel economy vehicles (due to increases in the Corporate Average Fuel Economy [CAFE] requirements), and consumer behavior changes. Gasoline vehicle usage drives the projections, since gasoline vehicles account for roughly 68% of transportation fuel. Diesel fuel vehicles account for an additional 19%. Therefore, these two classes account for roughly 87% of fuel usage, so demand projection on these fuels has the largest impact.

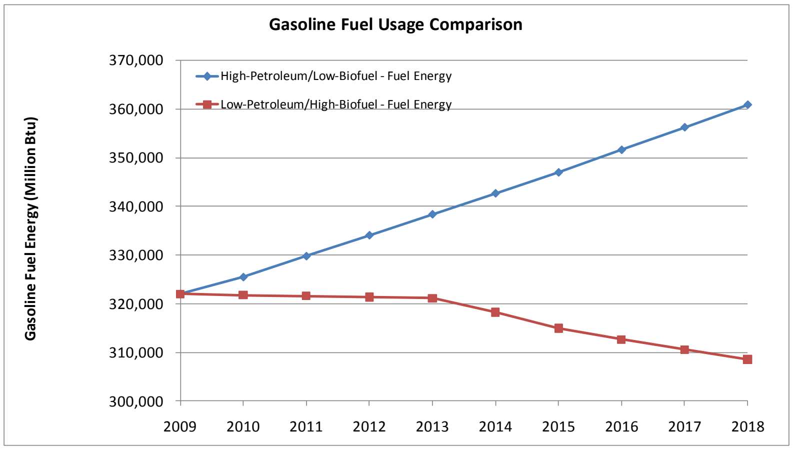
Exhibit 14



4.2.3.1 Gasoline Demand

Gasoline fuel demand projections are shown in Exhibit 15. The High-Petroleum/Low-Biofuels case - "business-as-usual" - shows a steady increase in gasoline demand, as compared to the Low-Petroleum/High-Biofuels case, which illustrates a significant gasoline fuel demand decrease (14% in 2018). Reductions are due to higher renewable fuels usage (RFS), vehicles with higher fuel economy (CAFE), consumer behavior that values vehicle purchases that are energy efficient and reflect the impacts of higher fuel prices and increased environmental sensitivity.

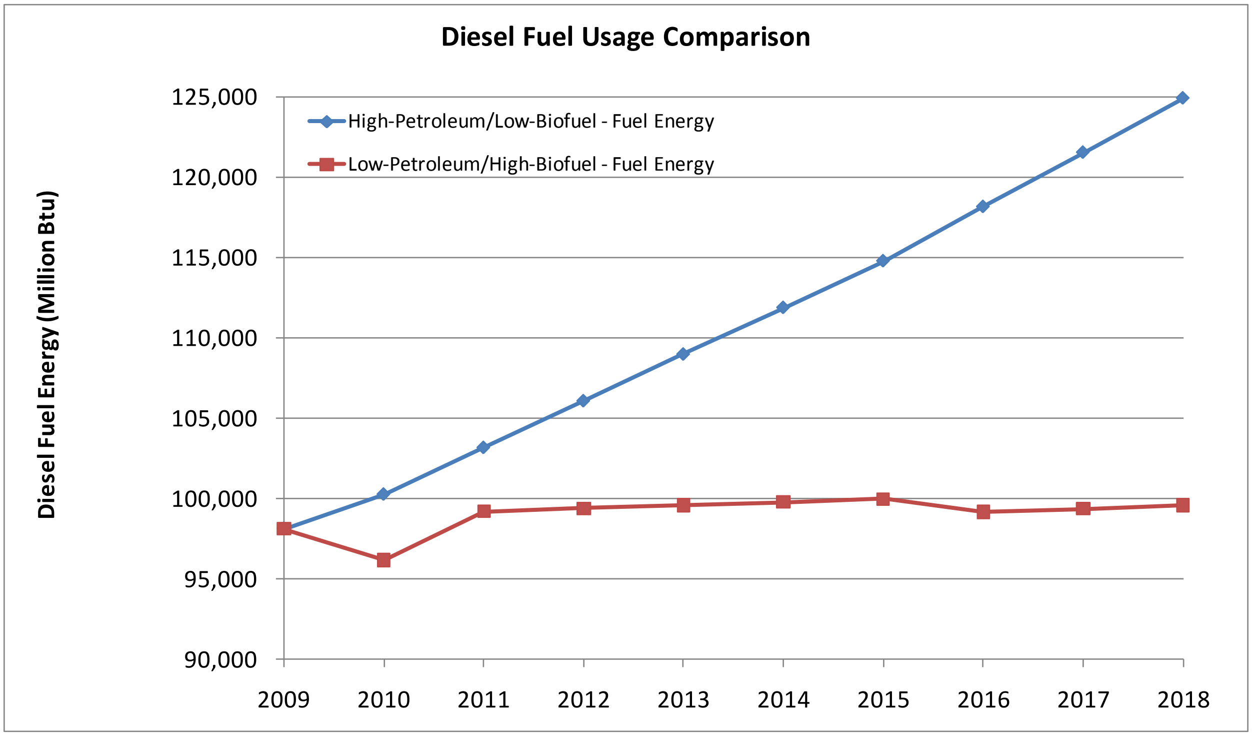
Exhibit 15



4.2.3.2 Diesel Demand

Diesel fuel demand projections are shown in Exhibit 16. The High-Petroleum/Low-Biofuels case shows a steady increase in diesel demand. The difference between the "business-as-usual" High-Petroleum/Low-Biofuels case and the Low-Petroleum/High-Biofuels results in a significant fuel demand decrease (20% in 2018) because of factors including higher renewable fuels usage (RFS). Vehicle fuel economy is not expected to significantly increase because options such as vehicle or engine displacement downsizing and hybrid powertrain systems are either not expected to be an option or are not expected to be widely used in typical diesel vehicle types.

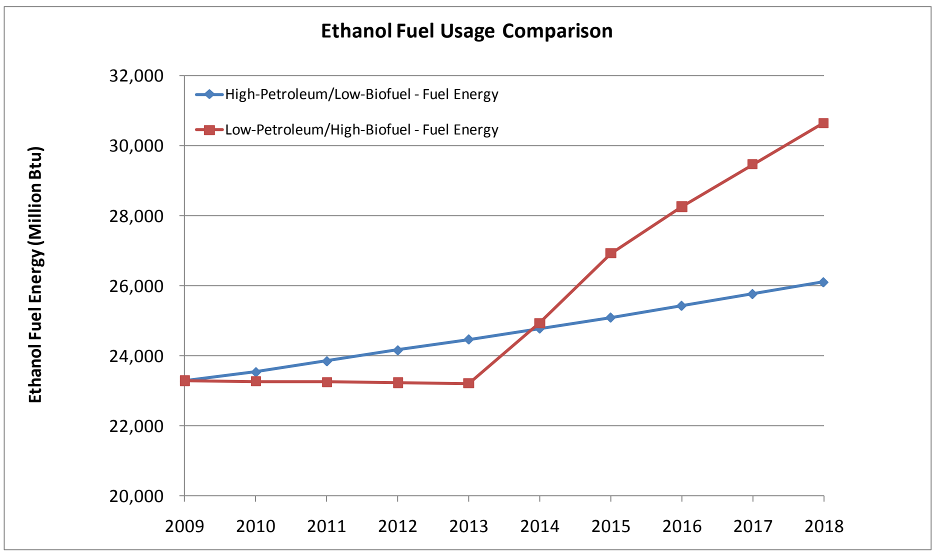
Exhibit 16



4.2.3.3 Ethanol Demand

Exhibit 17 shows the differences in ethanol fuel use projections and the impact of the EISA Renewable Fuel Standard. The E10 blend currently used in most gasoline in Maryland exceeds the EISA requirements on a percentage basis until 2014. Through 2014 the percentage of ethanol in the gasoline fuel pool is 10% by volume (7.2% on an energy basis). In order to meet the RFS after 2014 for ethanol, additional ethanol must be used. In later years in the High-Petroleum/Low-Biofuels case the percentage of ethanol remains at this percentage since ethanol usage is primarily assumed to come from ethanol in E10 gasoline. In the Low-Petroleum/High-Biofuels case the percentage increases to 13.26% in 2018 to keep pace with the EISA mandates.

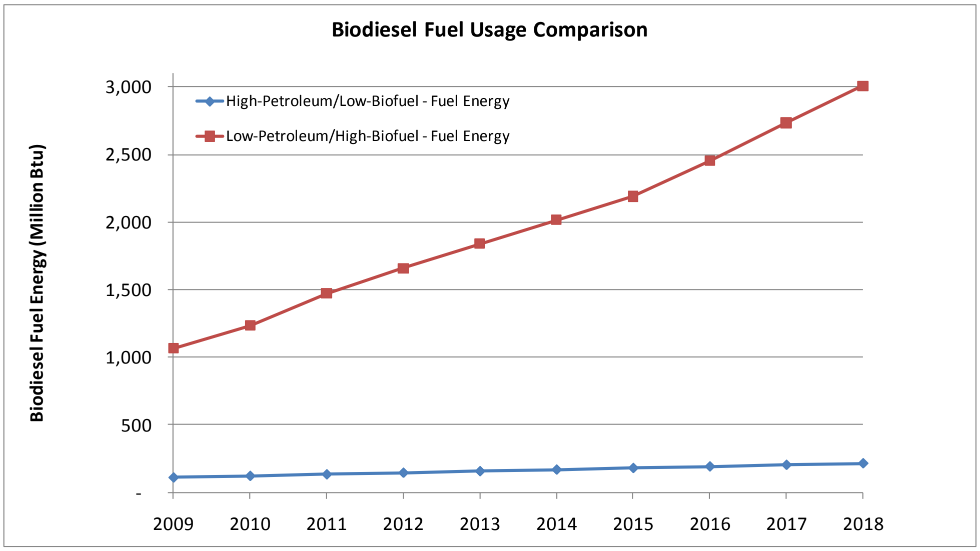
Exhibit 17



4.2.3.4 Biodiesel Demand

Exhibit 18 shows the differences in the biodiesel fuel use projections and the impact of the EISA Renewable Fuel Standard (RFS). Biodiesel usage in Maryland has been increasing, but not at a rate that will allow the State to meet the RFS requirements. In fact, in the baseline year (2009) the RFS requirement is an estimated 9.8 times (8.1M gallons) higher than current usage.

Exhibit 18



4.2.3.5 Future Fuel Supplies

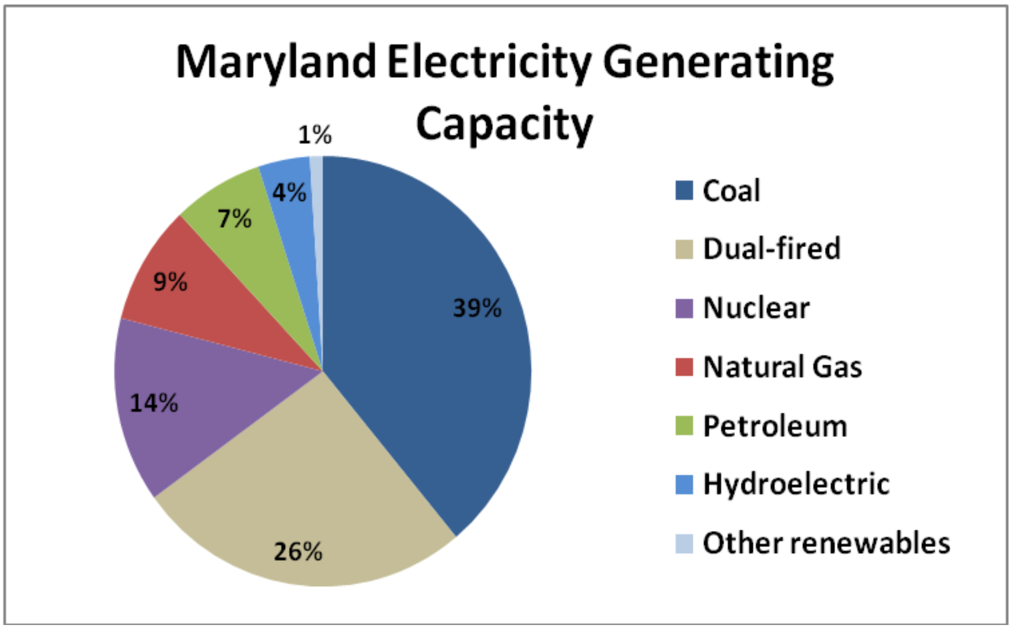
Demand and supply data for all the transportation fuels presents a clear picture of the need for some action. While the forecast assumes that market supplies of petroleum will be available to meet demand, history teaches a valuable lesson. Supply shortages in this energy intensive industry can have disastrous economic effects that reverberate throughout the economy. In the transportation sector there are potential physical supply shortages, supply disruptions, refinery capacity disruptions, transport difficulties and other factors that can lead to severe energy issues. The two most critical questions that must be answered are the extent to which new technologies for increasing fuel standards can help reduce petroleum demand and secondly, how we become more self-sustainable, by increasing the use of ethanol and biofuels in our transportation sector.

5.0 ELECTRICITY

5.1 Current Maryland Electricity Generating Profile

As seen in Exhibit 19, the largest percentage of electric generation capacity (power plants) located in Maryland is coal-fired. Coal-fired power plants contribute approximately 39% (4,966 MW) to the in-state summer peak capacity. Dual-fired plants which can run on either gas or petroleum contribute roughly 26% (3,272 MW), nuclear power represents 14% (1,735 MW), gas (9% or 125 MW), petroleum (7% or 879 MW), hydroelectric (4% or 567 MW), and other renewable which include landfill gas and bio-mass (1% or 132 MW).

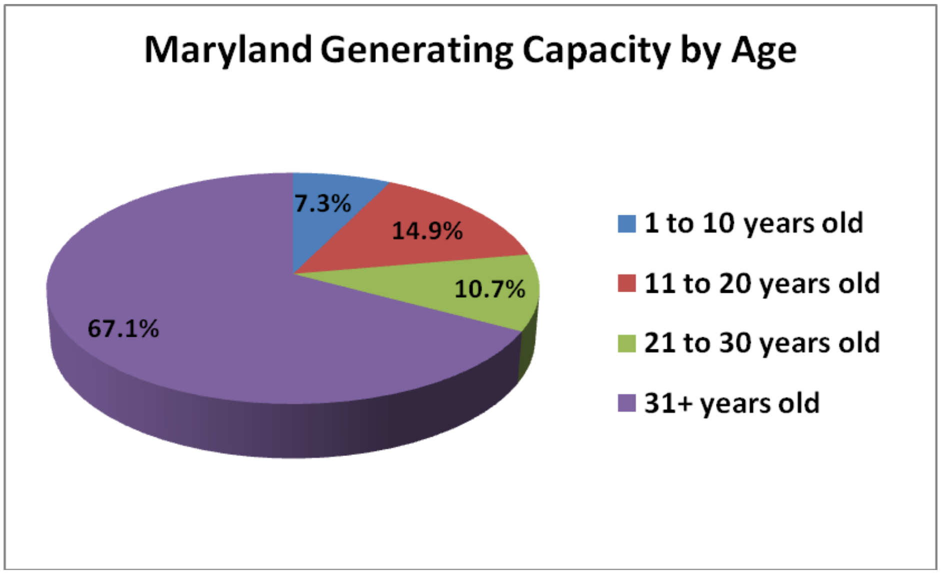
Exhibit 19



Source: Maryland Public Service Commission: *Ten Year Plan of Electric Companies in Maryland*; data as of January 1, 2009

As noted in Exhibit 20, the overhwhelming majority (67%) of eletricty generating infrastrucutre in Maryland is at least 30 years old. Table 3 lists the age of the state's largest generating units

Exhibit 20



Source: Maryland Public Service Commission Ten Year Plan of Electric Companies in Maryland

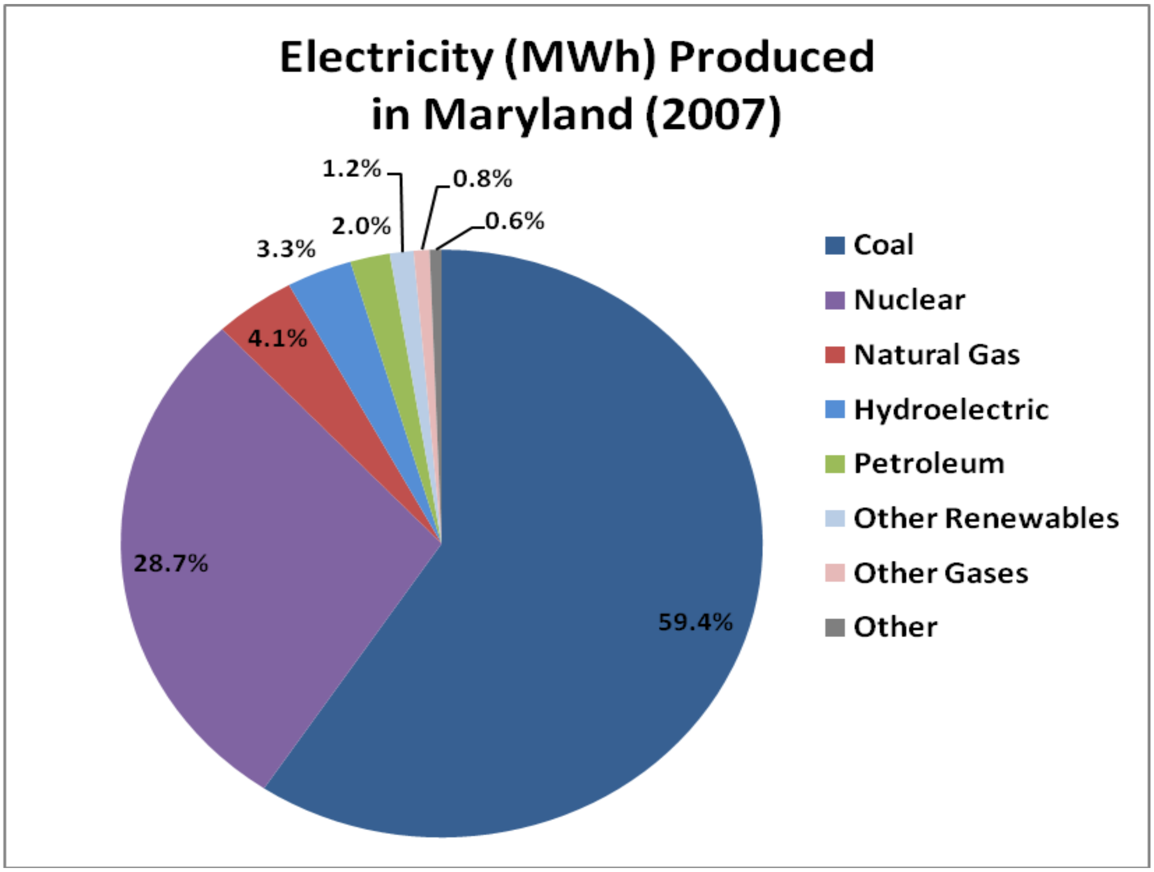
Table 3

Age of Maryland's Five Largest Electricity Generating Units	
Generating Unit	**Year Units Put in Service**
Chalk Point Generating Station	1964, 1965, 1975, 1981
Calvert Cliffs Nuclear Power Plant	1975, 1977
Morgantown Generating Station	1970, 1971, 1973
Brandon Shores Generating Station	1984, 1991
Herbert A. Wagner Generating Station	1956, 1959, 1966, 1972

Source: EIA

The exhibit below illustrates the energy (MWh) that is produced by Maryland's electric power plants. Nearly 60% (29,664,000 MWh) of all electricity generated in the State in the year 2007 was from coal. Another leading source, nuclear, generated nearly 29% (14,353,000 MWh) of energy, natural gas apporoximately 4% (2,033,000 MWh), hydroelectric (3.3% or (1,660,000 MWh), petroleum (2% or 979,000 MWh), other renewables (1.2% or (615,000 MWh), other gases (0.8% or 377,000 MWh) and other sources (0.6% or 287,000 MWh). For more information on renewable energy generation, see section 3.3.1.2

Exhibit 21

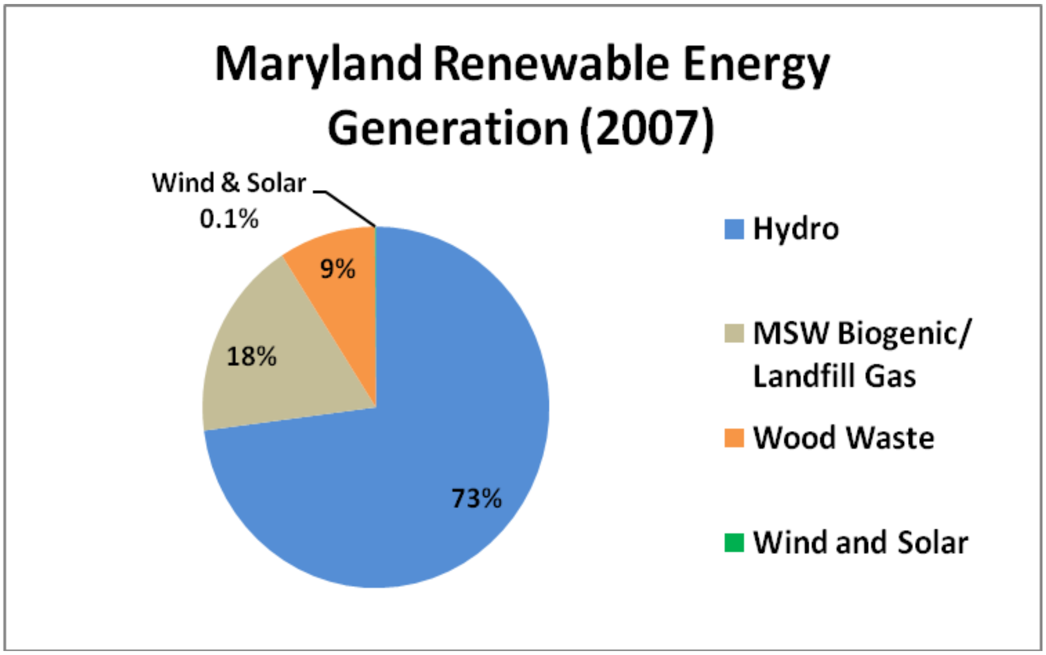


Source: Maryland Public Service Commission; Ten Year Plan of Electric Companies in Maryland data for 2007 (latest available)

5.2 Renewable Energy Generation in Maryland

Total renewable energy generation in 2007 for Maryland stood at 2,256,000 MWh. As seen in Exhibit 22, conventional hydroelectric power accounted for 73% (1,652,000 MWh) of this generation. Wood waste cogeneration of electricity represented about 9% (203,000 MWh) and Municipal Solid Waste (MSW) Biogenic[2] and Landfill Gas represented roughly 18% (400,000 MWh) of total renewable generation. Both wind and solar generated power represent a negligible amount of energy. Wind produced roughly 210 MWh per year and solar power approximately 3,300 MWh per year in Maryland. Together, these two energy sources represent approximately 0.1% of all renewable energy generation.

Exhibit 22



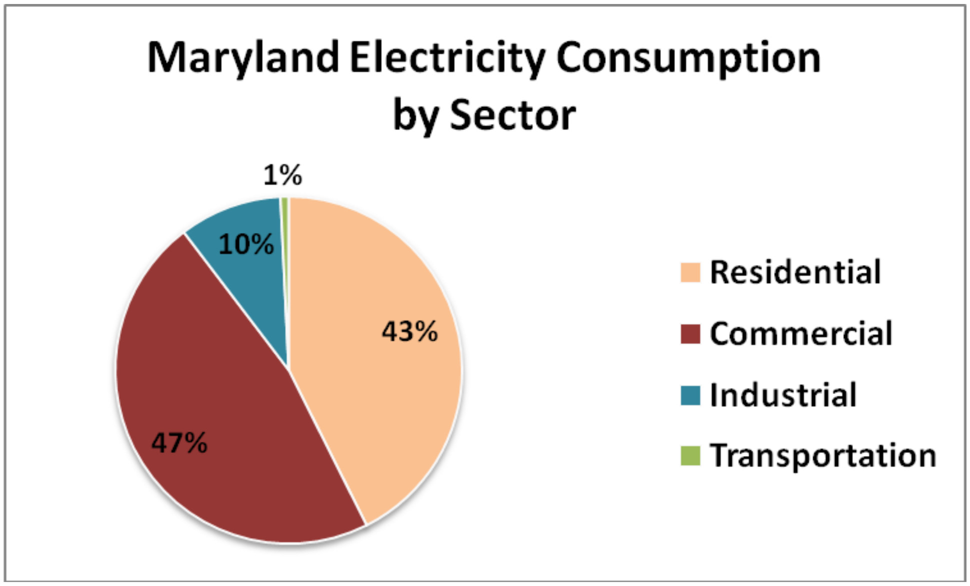
Source: EIA State Electricity Profiles, Maryland Energy Administration

[2] A biogenic substance is a substance produced by life processes.

5.3 Electricity Demand

The vast majority, 90%, of all of Maryland's electrical energy is consumed in the commercial and residential sectors. The industrial sector is responsible for 10% of Maryland's electricity demand, and the transportation sector accounts for approximately 1%.

Exhibit 23



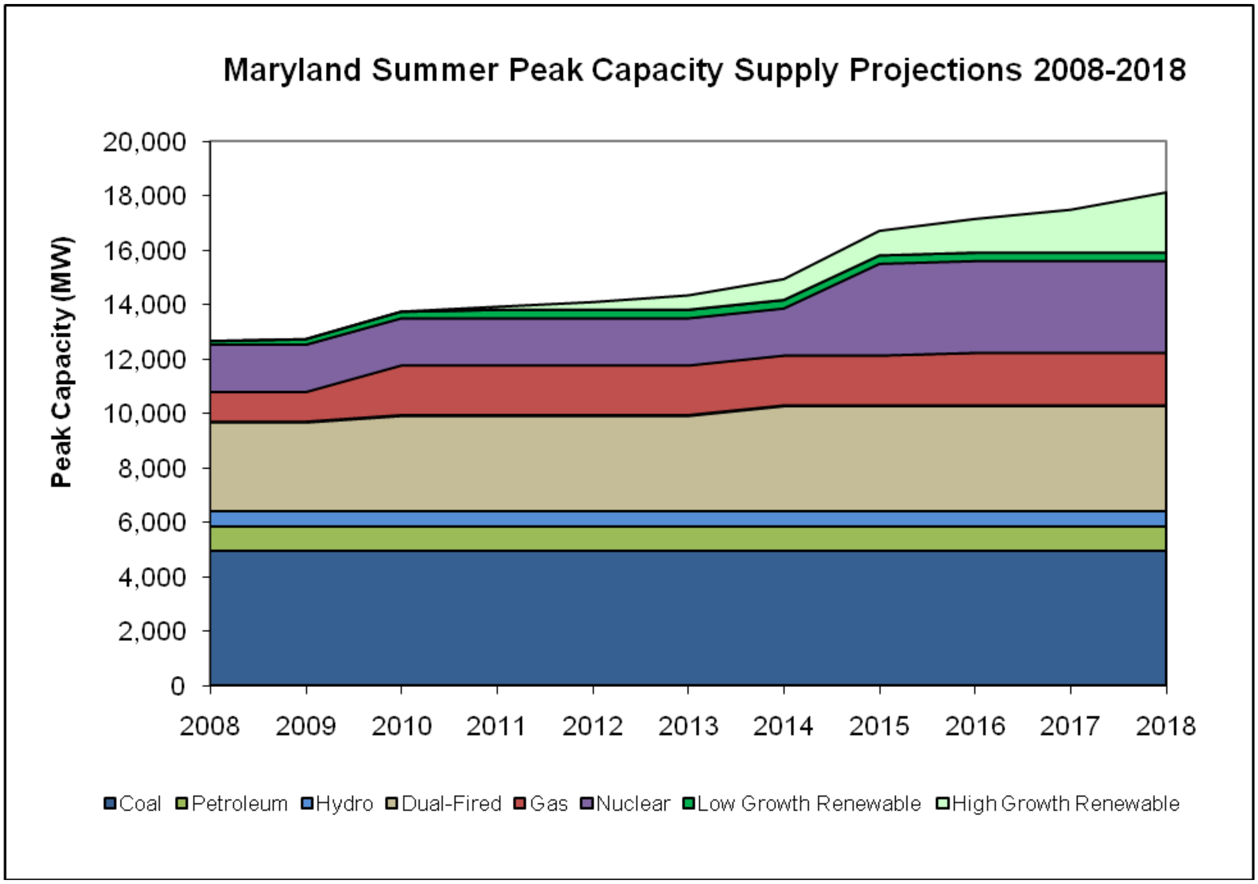
Source: EIA State Energy Data 2006 (latest available data)

5.4 Future Outlook for Electricity

5.4.1 Electricity Capacity Projection

As forecast by the Maryland PSC in 2008 and portrayed in Exhibit 24, total electric capacity for Maryland is forecasted to increase to almost 16,000 MWs by 2018. A significant portion of this increase can be attributed to the assumption of a gas facility at Perryman by 2010 and additional capacity at Calvert Cliffs Nuclear Power Plant by 2015. Although neither of these are likely to occur in the time frame that was forecast, their absence or delay will serve to show the continuing imbalance between electric demand and supply in Maryland. If these or other plants were actually built in Maryland in a timely fashion, they would help to offset a significant portion of Maryland's energy imports and perhaps help reduce energy prices, but Maryland would continue to be dependent energy imports. In addition, the exhibit includes two "wedges" – low and high growth scenarios – for renewable energy. If the high growth renewable energy scenario were achieved and the other capacity additions materialize, Maryland's total electric capacity could top 18,000 MW in 2018.

Exhibit 24



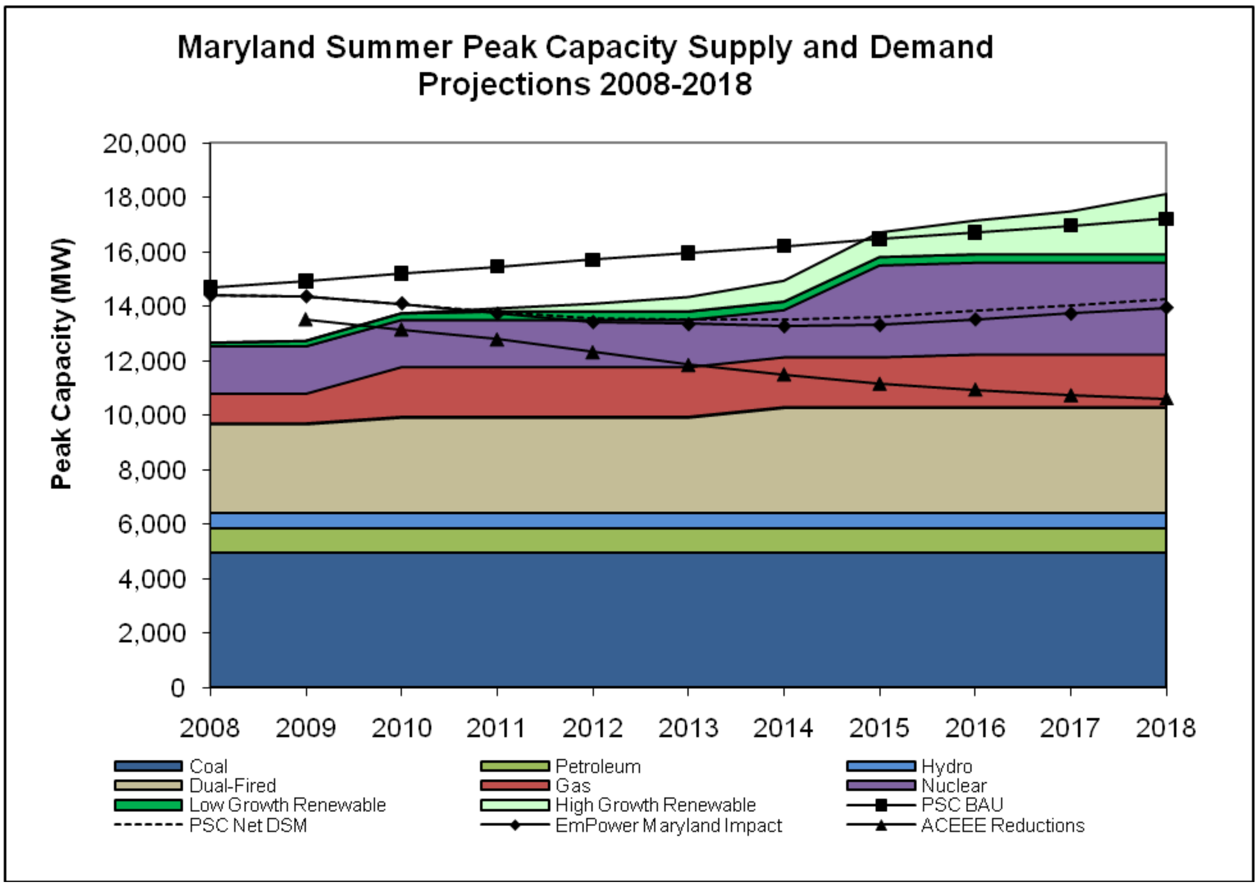
Note: Projection assumes new gas and dual-fired generation units between 2009-2015 as currently proposed, and Calvert Cliffs additional nuclear unit in 2015.
Source: Maryland Public Service Commission, Princeton Energy Resources International

The dark green wedge portrays the capacity of current renewable energy generation (not including large hydro, which is portrayed separately) and known renewable energy additions between 2009 and 2018. All known significant renewable energy additions will come from wind. The light green wedge represents a high growth scenario for renewable energy – a growth scenario of more than 2,000 MWs by 2018 that could potentially be achieved if the state aggressively pursues untapped renewable energy sources.

Exhibit 25 incorporates the capacity supply projection with four different capacity demand scenarios, represented by the horizontal and sloped lines. The "square" line, or "PSC BAU," demonstrates a high demand forecast that encompasses a "business as usual" approach as projected by Maryland Public Service Commission. The "dashed" line, or "PSC Net DSM," beneath the business as usual forecast represents the demand savings reflected by current DSM programs proposed (and in some cases underway) by the State's major investor-owned utilities. The "diamond" line represents the demand savings outlook if the EmPower Maryland goals are met. Finally, the "triangle" line displays the demand reductions that would occur if all of ACEEE's recommendations are enacted.

The deviation in these demand lines demonstrates the difference in forecasted capacity demand and supply. It is clear that the electric capacity needed in the State would vary greatly depending on the scenario utilized.

Exhibit 25



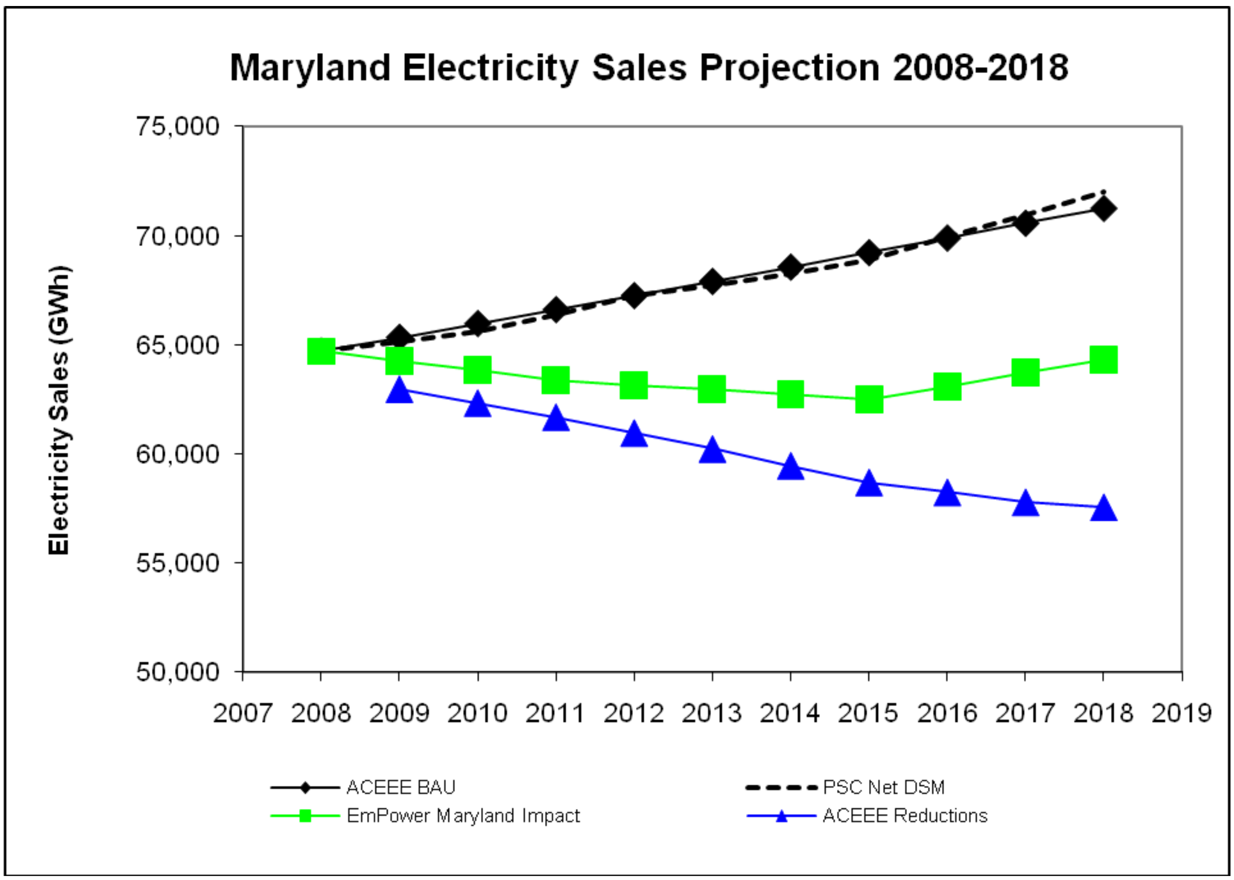
Source: Maryland Public Service Commission, EmPower Maryland legislation, ACEEE, Princeton Energy Resources International

5.4.2 Electricity Sales Projection

Exhibit 26 includes four different electricity sales projections for Maryland. The black "diamond" line, or "ACEEE BAU," represents a business-as-usual electricity sales forecast based on projected average annual growth rate of 0.97% in the ACEEE's *Energy Efficiency: The First Fuel for a Clean Energy Future* report published in February 2008; the starting value for the "ACEEE BAU" line is the Maryland PSC's Ten Year Plan's value for 2008. The "dashed" line, or "PSC Net DSM," portrays the electricity sales forecast included in the Maryland Public Service Commission's *Ten Year Plan (2008-2017) of Electric Companies in Maryland* published in February 2009. The green "square" line, or "EmPower Maryland Impact," portrays electricity sales in Maryland if the electricity use reduction goals established by the EmPower Maryland legislation are achieved. Finally, the blue "triangle" line, or "ACEEE Reductions," displays the sales reductions that would occur if all of ACEEE's recommendations are enacted.

According to the *Ten Year Plan (2008-2017) of Electric Companies in Maryland*, the sales projection included in the report ("PSC Net DSM" line in Exhibit 26) includes the expected impact of utility companies' current demand side management programs. As is evidenced by the electricity sales projection chart, these current sales projections do not point towards Maryland achieving its EmPower Maryland energy reduction goals.

Exhibit 26

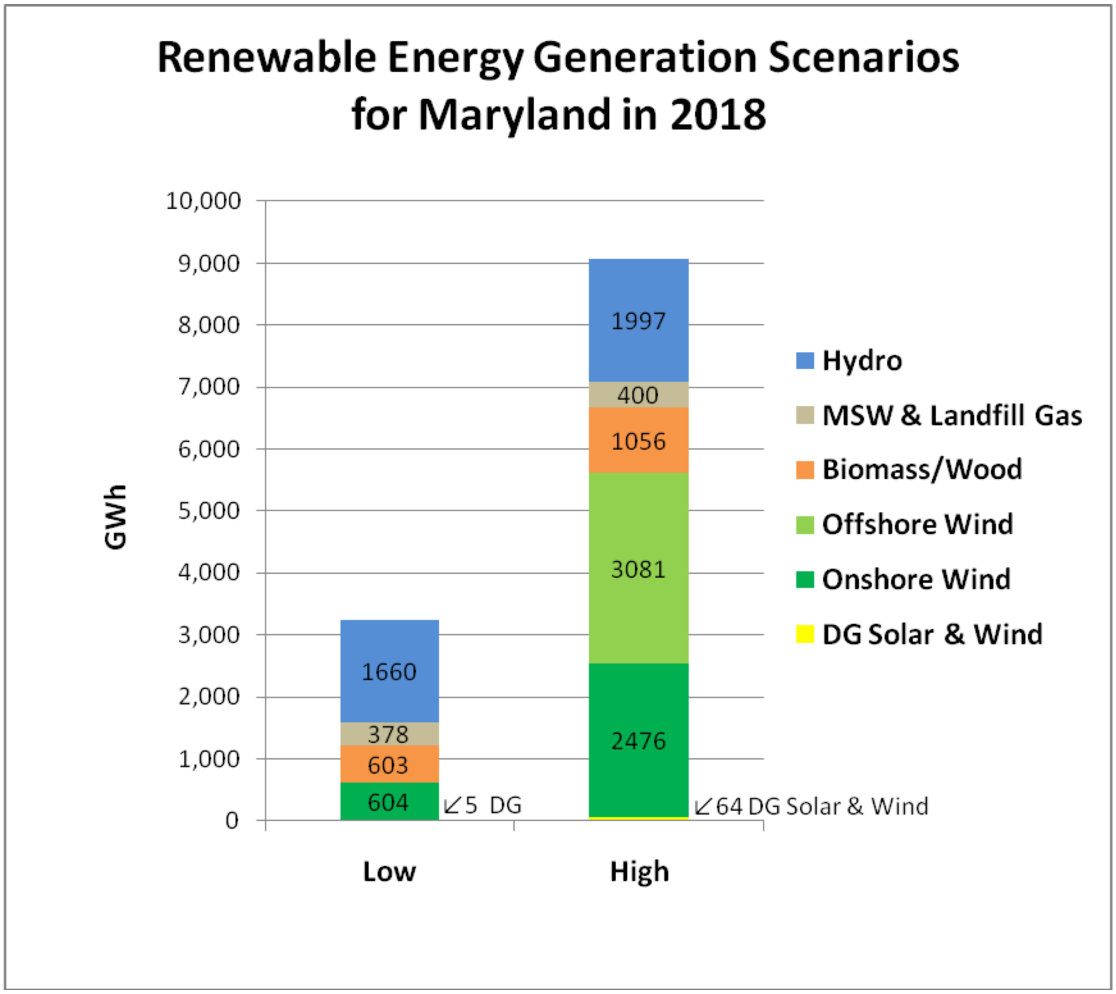


Source: Maryland Public Service Commission, EmPower Maryland legislation, ACEEE

5.4.3 Renewable Electricity Projection

As portrayed in Exhibit 24, two growth scenarios for renewable electricity production are presented. Exhibit 27 portrays the projected mix of renewable electricity generations for the two different scenarios. While either of these scenarios are possible, the high growth scenario will likely depend on policies designed to help offset the higher costs for renewable plants and to support broad development of these resources.

Exhibit 27



Note: MSW=Municipal Solid Waste; DG=Distributed Generation.
Source: Maryland Public Service Commission, EIA, Princeton Energy Resources International

Under the low growth scenario, 230 MW of currently proposed onshore wind energy will be added to Maryland's electricity generation mix. These are projects currently in the permitting process. In this scenario, no other renewable energy generation capacity is projected to come online before 2018.

The high growth scenario assumes that Maryland aggressively pursues and develops all available forms of renewable electricity production. This scenario includes growth in all renewable electricity sources, including hydro, municipal solid waste (MSW) and landfill gas, wood and other biomass, both onshore and offshore wind, and distributed small wind and solar energy.

In the low growth scenario, the only significant difference between Maryland's renewable electricity production between 2009 and 2018 will be in the area of wind generation. The addition of 230 MW of onshore wind would mean that in 2018 approximately 19% of Maryland's renewable electricity generation would come from wind. In terms of total renewables, the low case scenario would have Maryland providing approximately 6% (assuming EmPower Maryland is fully enacted) of a mandated 18% (by the year 2022) needed for the State's Renewable Portfolio Standard (RPS) by 2018.

In the high growth scenario, Maryland's renewable electricity generation picture will look very different from today. Most importantly, total renewable electricity generation would triple compared to the low growth scenario. Even though the high growth scenario entails increases in all forms of renewable electricity production, the majority of growth would come from onshore and offshore wind development. Under the high growth scenario, in 2018 approximately 61% of Maryland's renewable electricity generation would come from wind. The high growth scenario assumes that Maryland would have around 900 MW capacity of onshore wind, approximately 1,000 MW of offshore wind, and 50 MW of new solar capacity in 2018. In terms of total renewables, the low case scenario would have Maryland providing approximately 15% (assuming EmPower Maryland is fully enacted) of a mandated 18% (by the year 2022) needed for the State's RPS by 2018.

Maryland's RPS law specifies that all solar energy requirements must be met with resources within the State. To fulfill the 2.0% percent solar set-aside by 2022 would require the development of approximately 1,500 MW of solar capacity. Even the high growth scenario portrayed in Exhibit 27 falls short of this goal.

5.5 Future Choices

Under just about any forward looking scenario, Maryland continues as a net importer of electrical energy. A best case scenario includes significant new generation, including more renewable generation coupled with the achievement of EmPower Maryland peak demand and energy use reduction goals. This ensures that Maryland will be able to maintain electrical supply to meet demand. If the Calvert Cliffs plant is available by 2015, Maryland would be able to meet the high case demand in that time frame.

Looking at the imbalance between electric demand and supply realistically, it would appear that Maryland needs to take action on multiple fronts to avoid energy shortfalls. The question to be asked is what policies or actions are needed to meet our energy goals and to secure affordable, reliable and clean energy for our future. Do we have adequate supplies? What do we need to do to increase Maryland supplies and move toward a more sustainable future? Are there specific actions that should be taken?